

1966 OPERATING SUMMARY

KITCHENER

water pollution control plant

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ONTARIO WATER RESOURCES COMMISSION
Division of Plant Operations

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ONTARIO WATER RESOURCES COMMISSION
OFFICE OF THE GENERAL MANAGER

Members of the Kitchener Local Advisory Committee,
City of Kitchener.

Gentlemen:

We are pleased to submit to you the 1966 Operating Summary for the
Kitchener Water Pollution Control Plant, OWRC Project No. 58-S-19.

It is hoped that our joint participation in efforts to combat water pollution
will have even more success in the coming year.

Yours very truly,

A handwritten signature in dark ink, appearing to read "D. S. Caverly".

D. S. Caverly,
General Manager.

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ONTARIO WATER
RESOURCES COMMISSION

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ONTARIO WATER RESOURCES COMMISSION

801 BAY STREET

TORONTO 5

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VICE-CHAIRMAN

D. S. CAVERLY
GENERAL MANAGER

W. S. MACDONNELL
COMMISSION SECRETARY

General Manager,
Ontario Water Resources Commission.

Dear Sir:

I am happy to present you with the 1966 Operating Summary for the
Kitchener Water Pollution Control Plant, OWRC Project No. 58-S-19.

The report offers a concise summary of operating data for the year and
comparisons with previous years where these are applicable and signifi-
cant.

Yours very truly,

A handwritten signature in cursive script, appearing to read "B. C. Palmer".

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

FOREWORD

● This operating summary contains complete information on the management of the project during 1966. It contains a concise review of the year's plant operation, significant financial details, and a visual presentation in graphs and charts of technical performance.

The information will be of value to interested parties in assessing the adequacy of the project at this time and its ability to meet future requirements.

The report is the result of co-operation by several groups within the Division of Plant Operations. These include the statistics section and the technical publications section. The Division of Finance and the draughting section of the Division of Sanitary Engineering were also closely associated with its publication.

The Regional Operations Engineer, however, has had the primary responsibility for the content, and will be happy to answer any questions regarding it.

C O N T E N T S

Foreword	1
Title Page	3
'66 Review	5
Project Costs	6
Operating Costs	8
Process Data	11
Conclusions	Inside back cover

KITCHENER
water pollution control plant
operated for

THE CITY OF KITCHENER

by the

ONTARIO WATER RESOURCES COMMISSION

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DIVISION OF PLANT OPERATIONS

DIRECTOR: B. C. Palmer

Assistant Director: C. W. Perry
Regional Supervisor: D. A. McTavish
Operations Engineer: B. W. Hansler

801 Bay Street Toronto 5

'66 REVIEW

A total of 3,457.80 million gallons of sewage was treated at the Kitchener Water Pollution Control Plant during the year at a total cost of \$279,143. The operating cost per million gallons was \$80.73 and the cost per pound of BOD removed was \$0.036.

The average daily flow of 9.5 million gallons was 4.4% greater than the 1965 average flow of 9.1 million gallons. The average suspended solids concentration decreased from 417 ppm in 1965 to 338 ppm in 1966, and the average BOD concentration from 320 ppm to 236 ppm.

The average effluent suspended solids and BOD concentrations of 18 ppm and 14 ppm respectively were considerably lower than the corresponding values in 1965 of 42 ppm and 38 ppm, and were approximately equal to the OWRC objective of 15 ppm for each. The average suspended solids and BOD removal efficiencies were 94.5% and 94% respectively.

Due to the increased quantity of sludge pumped to the digesters, the reduction in volatile matter was less than in previous years. The reduction in volatile matter averaged 30.5% in 1966 compared with 47.7% in 1965.

Sludge haulage costs include both liquid sludge and filtered sludge haulage. Liquid digested sludge is removed by tank truck, since the capacity of the vacuum filter is not sufficient to dewater all the sludge produced. During the clean-out of the primary digesters, the contents were removed by tank truck, resulting in an increased cost for sludge haulage.

Repair work on the aeration section, consisting of levelling of the bridges, alignment of the line shafts, replacement of bearings and inspecting the gear-heads, was completed in December.

Under the supervision of head office engineers, the plant staff has operated a clean, attractive and efficient plant for the City of Kitchener.

PROJECT COSTS

STAGE 1

NET CAPITAL COST (Final)	
Long Term Debt to OWRC	\$ <u>1,312,746.07</u>
Debt Retirement Balance at Credit (Sinking Fund) December 31, 1966	\$ <u>383,304.53</u>
Net Operating	\$ 279,143.47
Debt Retirement	47,626.00
Reserve	8,280.95
Interest Charged	73,858.12
	<hr/>
TOTAL	\$ <u>408,908.54</u>

RESERVE ACCOUNT

Balance at January 1, 1966	\$ 69,234.50
Deposited by Municipality	8,280.95
Interest Earned	<u>3,994.11</u>
	\$ 81,509.56
Less Expenditures	720.12
	<hr/>
Balance at December 31, 1966	\$ <u>80,789.44</u>

STAGE 2

NET CAPITAL COST (Estimated)	\$1,488,607.70
DEDUCT - Portion Financed by CMHC (Estimated)	<u>1,016,967.77</u>
Long Term Debt to OWRC	\$ <u>471,639.93</u>
Debt Retirement Balance at Credit (Sinking Fund) December 31, 1966	\$ <u>70,110.00</u>
Net Operating	\$ NIL
Debt Retirement	20,739.00
Reserve	10,074.30
Interest Charged	26,535.58
TOTAL	\$ <u>57,348.88</u>

RESERVE ACCOUNT

Balance at January 1, 1966	\$ 27,095.70
Deposited by Municipality	10,074.30
Interest Earned	<u>1,616.11</u>
	\$ 38,786.11
Less Expenditures	<u>7,306.08</u>
Balance at December 31, 1966	\$ <u>31,480.03</u>

MONTHLY OPERATING COSTS

MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIRS & MAINTENANCE	* SUNDRY	WATER
JAN	12196.17	7436.33	237.06		2342.32	1250.87	301.97		307.07	260.55	
FEB	17723.19	6842.55	280.74		2555.61	5161.11	547.26	25.65	954.74	1355.53	
MARCH	13819.77	7008.53	555.54		2832.11	1527.76	202.94	194.14	204.45	1294.30	
APRIL	2652.59	11964.91	980.71		2509.50	8545.46	382.37	106.98	717.80	1374.86	
MAY	20134.09	7534.98	784.90		2470.21	3855.82	300.97	313.63	225.90	4621.94	15.74
JUNE	20171.85	8359.17	633.11		2503.29	3459.55	826.43	512.10	119.10	2759.10	
JULY	23038.67	7971.05	1591.07		2218.02	6776.93	450.66	237.59	627.59	3165.11	
AUG	21657.80	7919.56	1103.49		2203.35	3948.70	352.00	1237.57	1393.59	3499.54	
SEPT	31439.02	11952.14	1619.57		2373.07	7052.90	416.91	18.76	1485.64	6506.63	41.40
OCT	30893.11	8052.05	849.93		2286.65	5210.64	524.21	139.08	1400.12	2400.43	
NOV	27202.68	8155.11	776.42		2324.71	6864.71	580.13	87.32	2454.07	5958.21	
DEC	34204.53	8116.25	795.52	4800.54	2815.69	8775.55	630.22	30.45	1769.79	6423.28	39.24
TOTAL	279143.47	101373.23	10210.06	4800.54	29434.53	62430.05	5516.07	2953.27	12659.86	7111.90	106.38

* SUNDRY INCLUDES SLUDGE HAULING COSTS WHICH WERE \$31,731.49

YEARLY OPERATING COSTS

YEAR	M.G. TREATED	TOTAL COST	COST PER FAMILY PER YEAR	COST PER MILLION GALLONS	COST PER L.B. OF BOD REMOVED
1961	2649.60	\$119,269.00	* \$ 5.73	\$ 50.30	3.8 CENTS
1962	3254.55	\$100,007.00	\$ 4.88	\$ 30.72	2.4 CENTS
1963	2841.14	\$137,547.00	\$ 6.82	\$ 49.46	2.8 CENTS
1964 **	3026.52	\$217,425.00	\$10.57	\$ 71.84	1.7 CENTS
1965	3328.10	\$225,144.00	\$10.61	\$ 67.65	2.0 CENTS
1966	3457.80	\$279,143.00	\$12.56	\$ 80.73	3.6 CENTS

* BASED ON ESTIMATED ANNUAL POPULATION AND 3.9 PERSONS PER FAMILY

** AERATION PORTION OF PLANT PLACED IN OPERATION

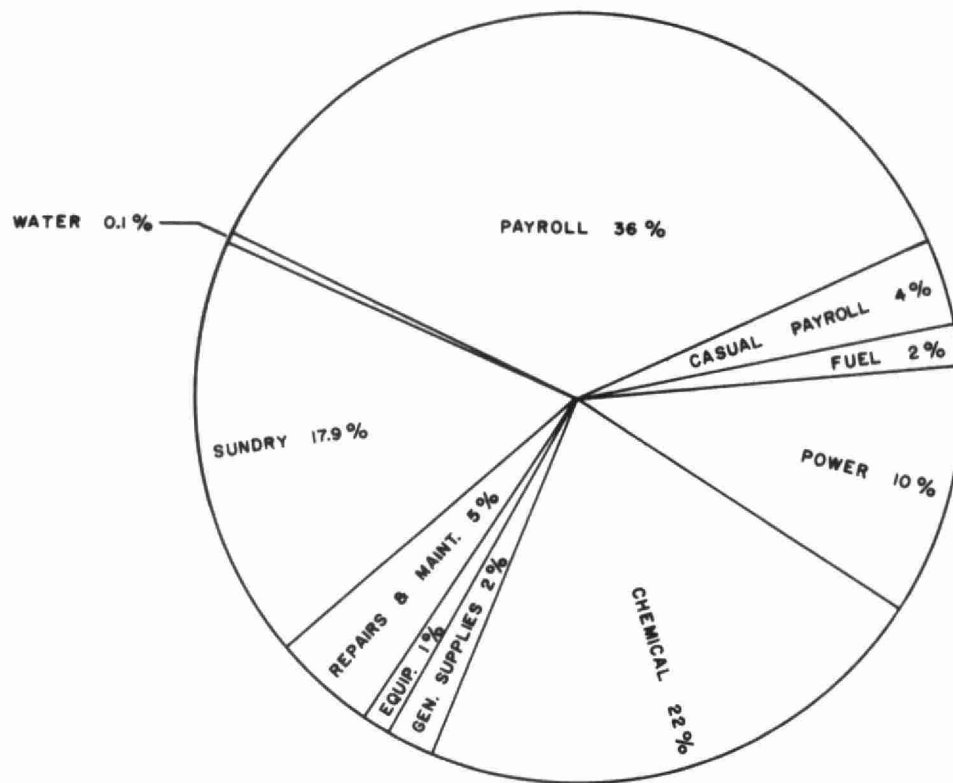
VACUUM FILTER COSTS (MONTHLY)

MONTH	COST PER MONTH					TOTAL	COST PER TON DRY WEIGHT					TOTAL
	FeCl ₃	LIME	LABOUR	ELEC	MAINT		FeCl ₃	LIME	LABOUR	ELEC	MAINT	
JANUARY	1282.13	1042.29	888.62	251.58	86.42	3551.04	5.20	4.23	3.60	1.02	0.35	14.40
FEBRUARY	1297.00	1001.79	821.54	260.66	80.34	3461.33	5.08	3.92	3.21	1.02	0.31	13.54
MARCH	1653.89	1320.90	1112.23	276.16	108.34	4471.60	6.11	4.88	4.11	1.02	0.40	16.52
APRIL	1419.19	1114.76	917.06	263.11	90.08	3804.80	5.50	4.32	3.56	1.02	0.35	14.75
MAY	1834.49	1402.29	1139.82	360.42	110.77	4847.79	5.19	3.97	3.23	1.02	0.31	13.72
JUNE	1644.33	1309.79	1023.66	282.28	99.81	4359.87	5.94	4.73	3.70	1.02	0.36	15.75
JULY	1477.60	1270.67	993.17	225.37	97.38	4064.19	6.69	5.75	4.50	1.02	0.44	18.40
AUGUST	1542.32	1371.08	1229.26	354.25	120.51	4617.42	4.44	3.95	3.54	1.02	0.35	13.30
SEPTEMBER	1944.17	1326.68	1132.55	447.42	110.77	4961.60	4.43	3.02	2.58	1.02	0.25	11.30
OCTOBER	2072.49	1348.91	1195.00	417.59	116.86	5150.85	5.06	3.29	2.92	1.02	0.29	12.58
NOVEMBER	1627.81	1190.81	1000.43	363.63	97.38	4280.11	4.57	3.34	2.81	1.02	0.27	12.01
DECEMBER	1879.15	1189.08	1012.04	245.21	98.60	4424.08	7.82	4.95	4.21	1.02	0.41	18.41
TOTAL	19674.57	14889.13	12465.99	3747.73	1217.26	51994.68	66.03	50.35	41.97	12.24	4.09	174.68
AVERAGE PER MONTH	1639.55	1240.76	1038.83	312.31	101.44	4332.89	5.50	4.20	3.50	1.02	0.34	14.56

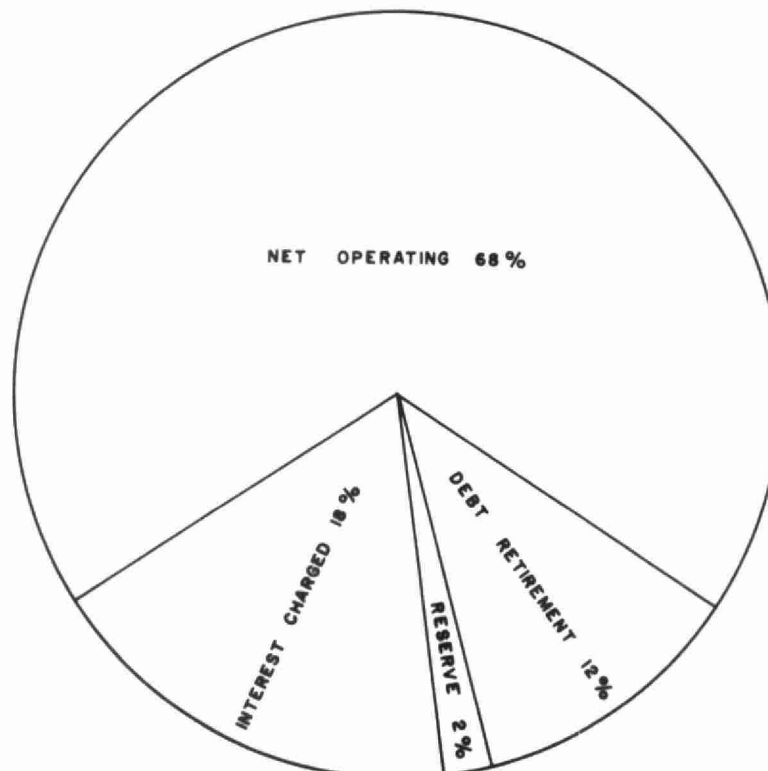
COMMENTS

The cost of vacuum filter operation during 1966 was \$51,994.68, or \$14.65 per ton of dry solids filtered. Raw sludge from the primary clarifiers was filtered during August and September while the primary digesters were being cleaned out and also in October and November to relieve the loading on the digesters. During this period, the cost of sludge conditioning chemicals was lower than the average for the year but the total chemical cost was not reduced since a larger amount of sludge was filtered.

1966 OPERATING COSTS



TOTAL ANNUAL COST

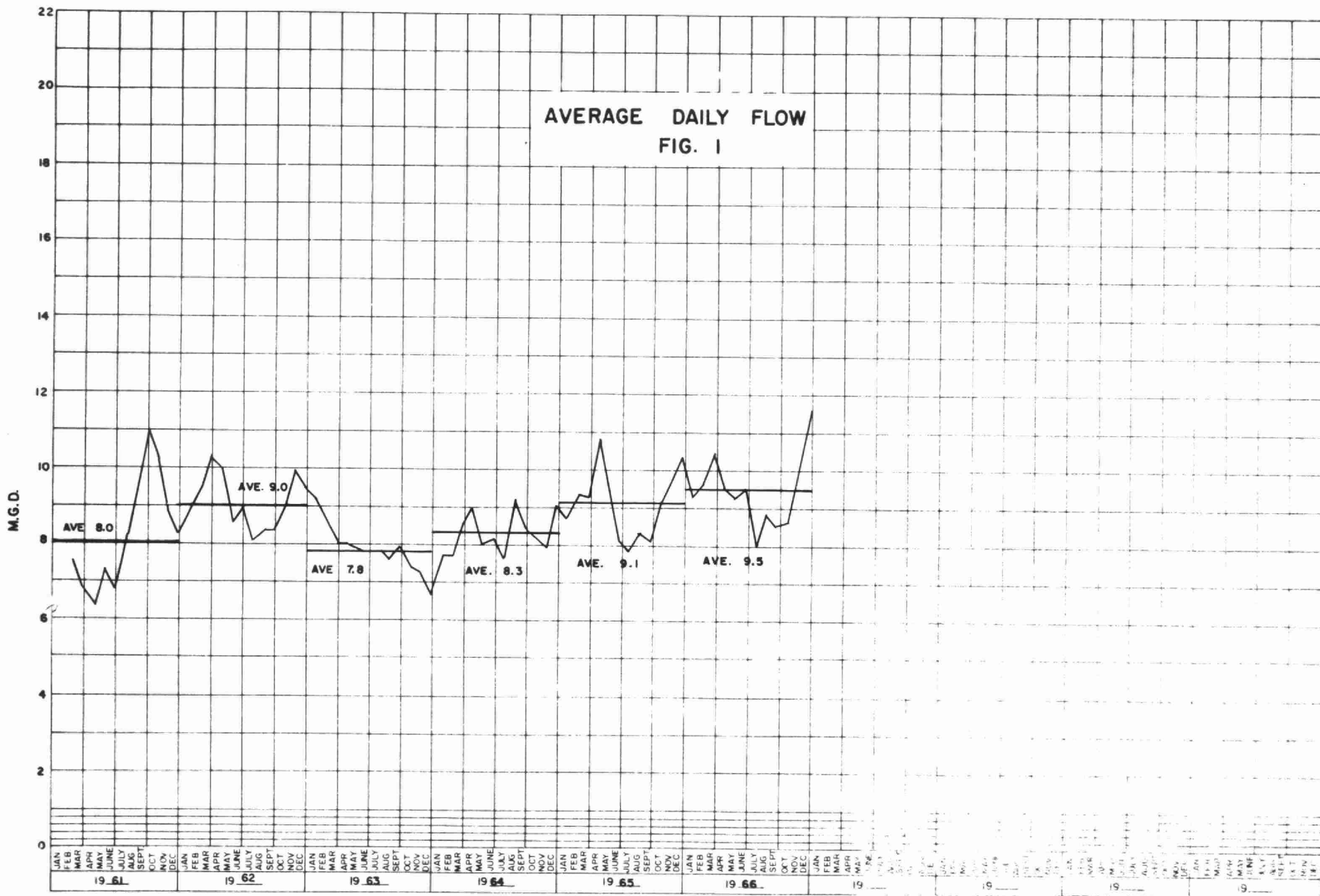


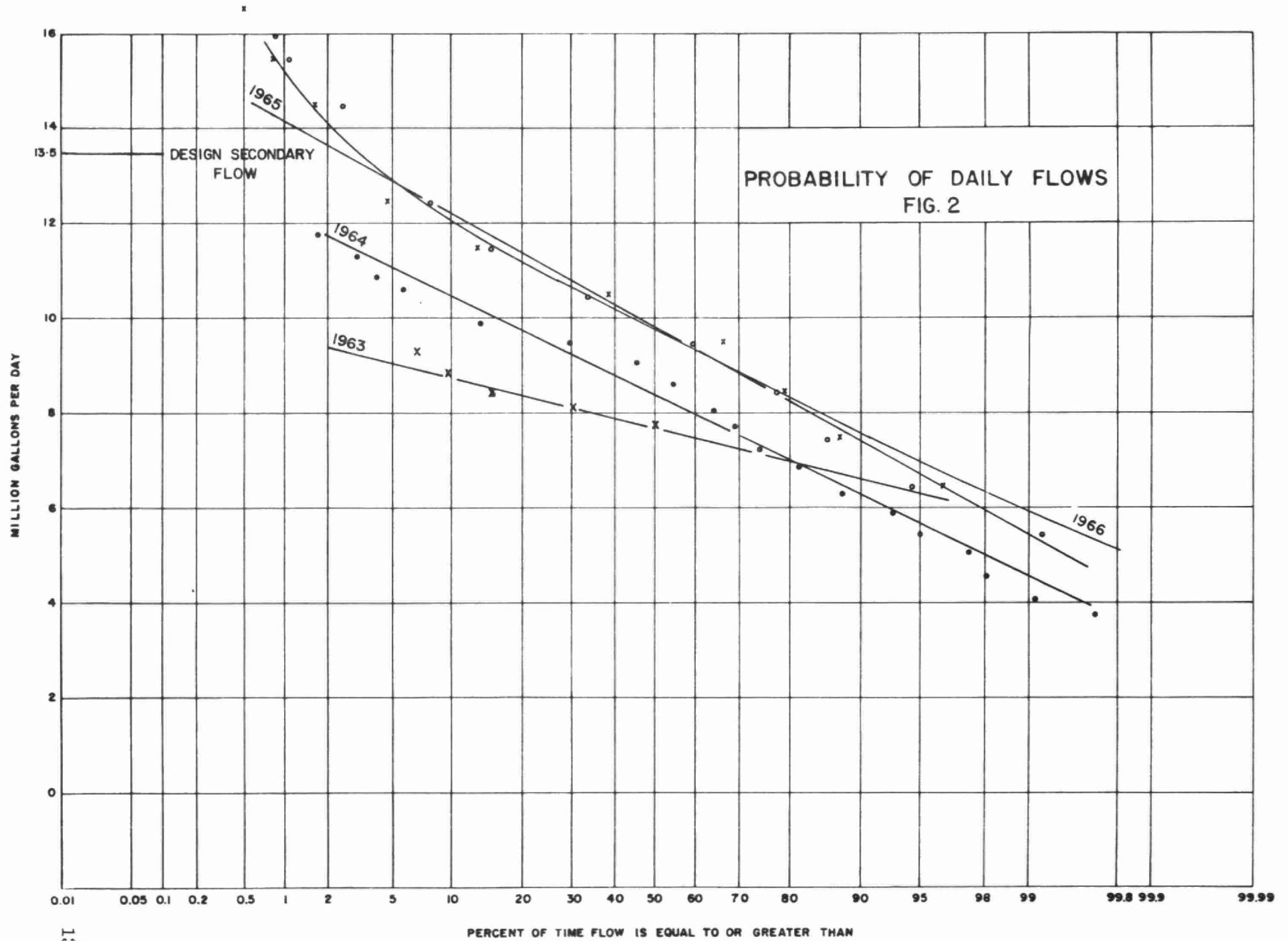
Process Data

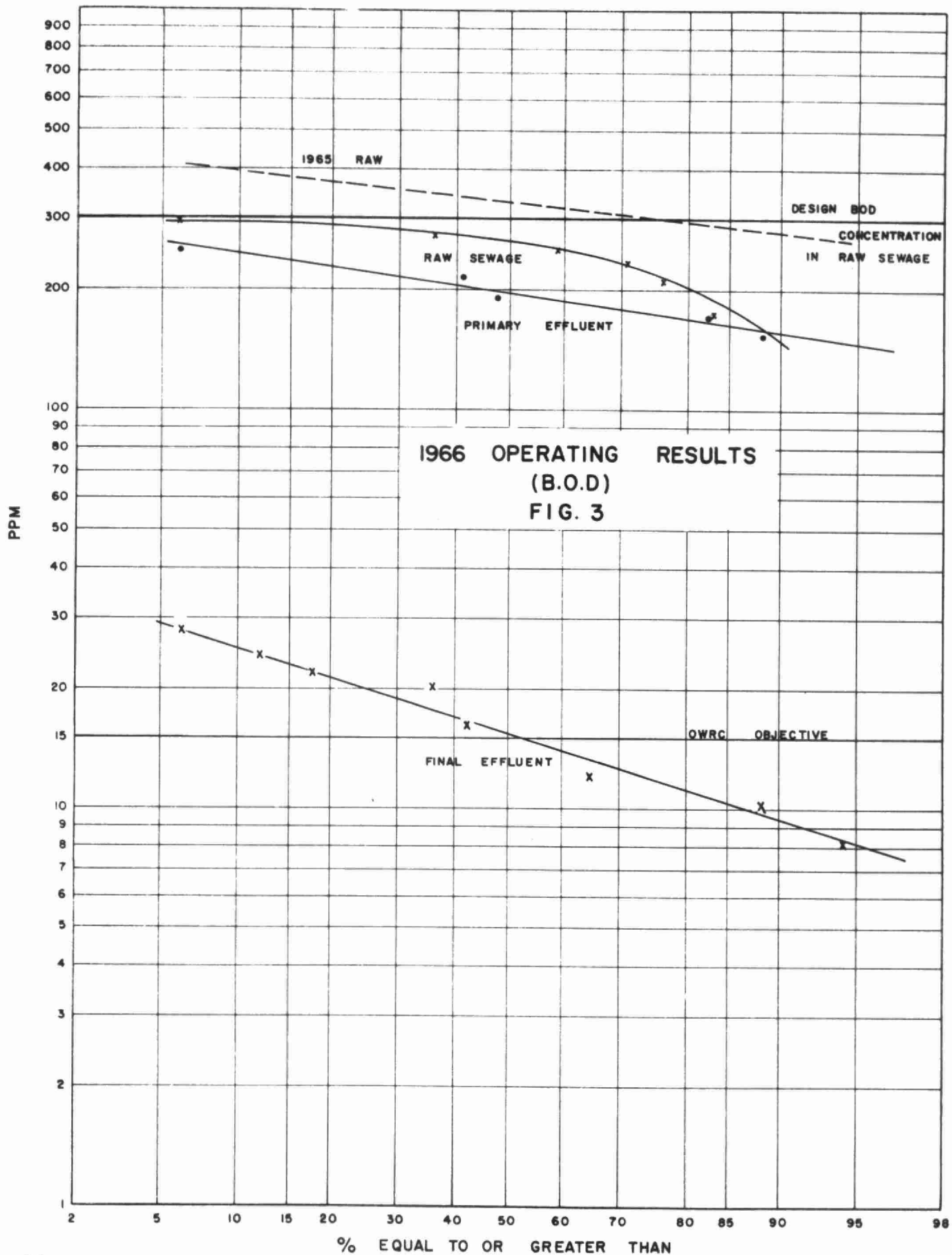
The total daily flows averaged by month for the period of February 1961 to December 1966 are shown on Figure No. 1. The average daily flow for 1966 of 9.5 mgd increased 4.4 percent as compared to the average daily flow of 9.1 mgd in 1965. During the past year, 3,458 million gallons of raw sewage composed of both domestic and industrial wastes received complete treatment.

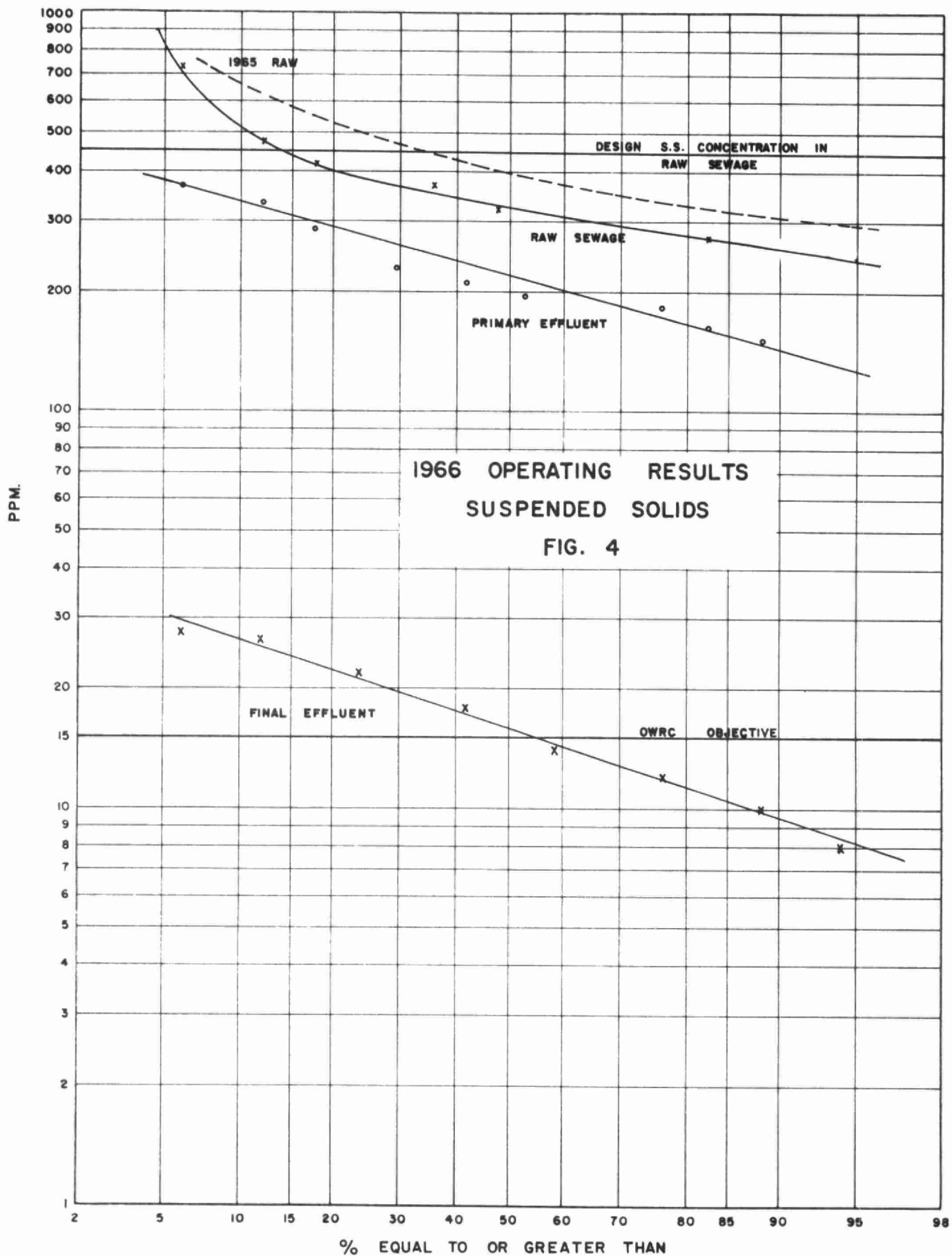
The maximum total daily flow averaged by month was 11.5 mgd and occurred in December. The average daily flow for the year of 9.5 mgd was exceeded, averaged on a monthly basis, during the months of January, March, April, November and December.

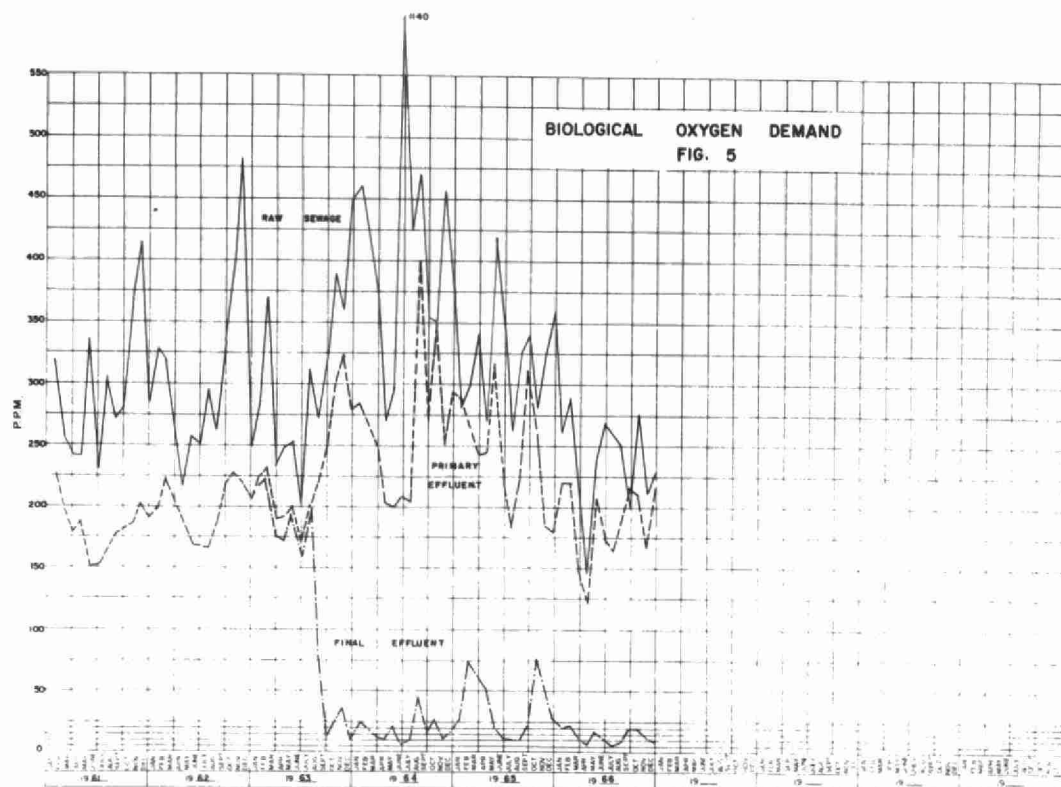
There are four aeration tanks with a design flow of 13.5 mgd. However, because of electric power supply limitations, only 75 percent of the aeration section can be utilized. As a result the design flow for the aeration section portion that can be utilized is 10.1 mgd. The flow exceeded the design primary and aeration section values of 11.0 mgd and 10.1 mgd, 23 percent and 44 percent of the time respectively. Probability flow curves for 1963, 1964, 1965 and 1966 are illustrated on Figure No. 2.



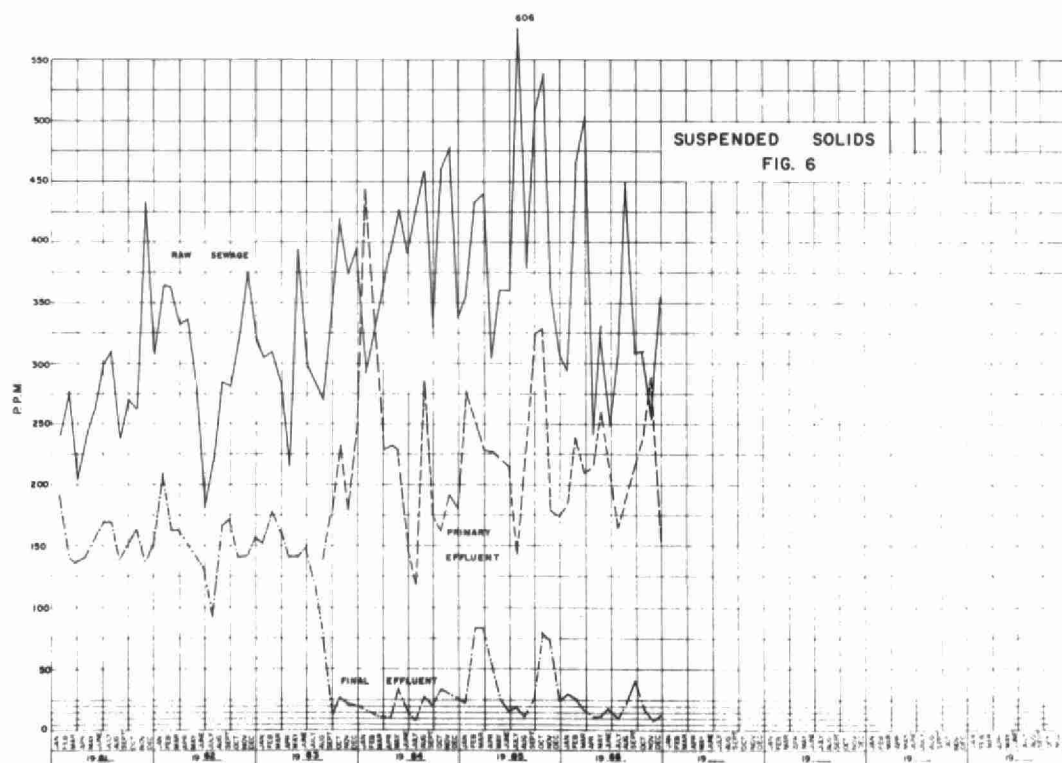








MONTHLY VARIATIONS



GRIT, B.O.D AND S.S. REMOVAL

K.T

MONTH	B. O. D.				S. S.				GRIT REMOVAL CU. FT.
	INFLUENT PPM.	EFFLUENT PPM.	% REDUCTION	TONS REMOVED	INFLUENT PPM.	EFFLUENT PPM.	% REDUCTION	TONS REMOVED	
JAN.	260	21	92.0	343.8	294	28	90.5	382.6	546
FEB.	290	23	92.0	360.2	464	26	94.5	590.9	595
MAR.	200	11	94.5	305.0	501	16	97.0	809.8	581
APR.	145	5	96.5	200.2	240	12	95.0	326.0	518
MAY	238	18	92.5	317.8	330	12	96.5	459.4	287
JUNE	270	12	95.5	367.3	248	17	93.0	328.8	637
JULY	260	8	97.0	314.4	310	10	97.0	374.2	721
AUG.	250	10	96.0	331.6	448	22	95.0	588.5	602
SEPT.	202	20	90.0	234.0	308	40	87.0	344.5	595
OCT.	275	20	92.5	342.3	312	17	94.5	396.0	642
NOV.	212	13	98.5	310.9	252	9	96.5	379.7	579
DEC.	228	11	95.0	384.1	354	12	96.5	605.3	837
TOTAL	-	-	-	3838.2	-	-	-	5532.5	7140
AVG.	236	14	94.0	319.8	338	18	94.5	461.0	595

COMMENTS

The BOD and suspended solids concentrations, based on twenty-four hour composite samples, of the raw sewage primary effluent and plant effluent are presented on probability plots in Figures No. 3 and 4 respectively. The influent, primary effluent and plant effluent BOD and suspended solids average for the month are plotted on an arithmetic basis on Figures No. 5 and 6 respectively.

The average raw sewage BOD concentration of 236 mg/l was 79 percent of the design value of 300 mg/l. Figure 3 indicates that the design value of the raw sewage BOD concentration was not exceeded in 1966. This is a reduction from 1965 when the influent BOD concentration exceeded the plant design figure 70% of the time. A total of 3838 tons of BOD was removed in 1966. The average BOD reduction efficiency was 94%.

The average plant effluent BOD concentration was 14 ppm. The OWRC

objective of 15 ppm for plant effluent BOD was exceeded 53 percent of the time.

The average raw sewage suspended solids concentration of 338 ppm represents 75% of the design concentration of 450 ppm. Figure 3 indicates that the raw sewage suspended solids concentration exceeded the design figure 14% of the time.

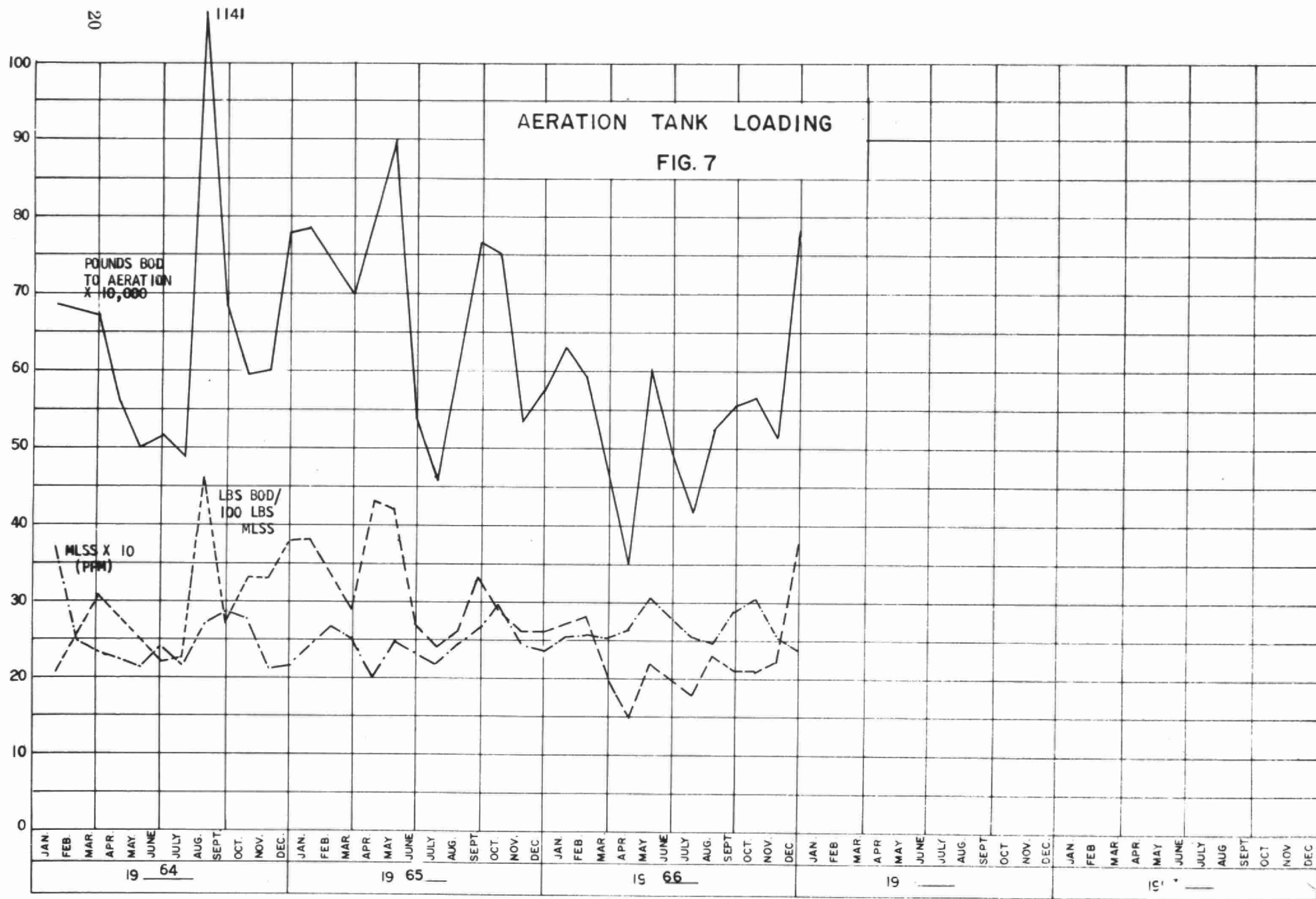
A total of 5533 tons of suspended solids was removed in 1966. The suspended solids reduction efficiency averaged 94.5%.

The average plant effluent suspended solids was 18 ppm. The plant effluent suspended solids exceeded the OWRC objective of 15 ppm 55 percent of the time.

A total of 7140 cubic feet of grit was removed during the year. This is equivalent to 2.07 cubic feet per million gallons of sewage treated.

AERATION TANK LOADING

FIG. 7

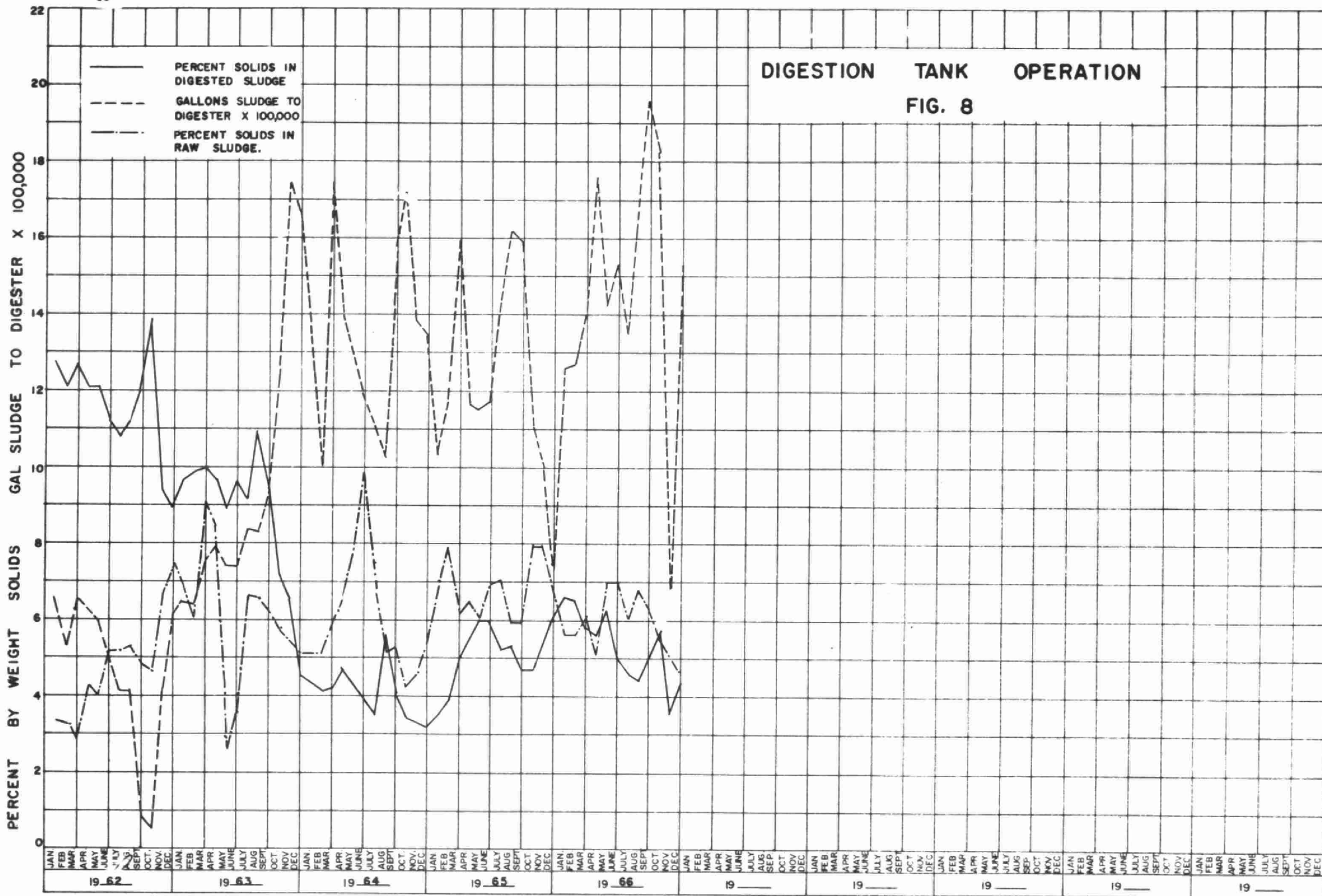


AERATION SECTION

MONTH	PRIM. EFFL B.O.D. PPM.	MLSS. PPM.	LBS. BOD. PER 100 LBS. M. L. S. S.
JANUARY	220	2520	27
FEBRUARY	220	2579	28
MARCH	145	2566	20
APRIL	120	2645	15
MAY	210	3014	22
JUNE	175	2796	20
JULY	165	2555	18
AUGUST	190	2479	23
SEPTEMBER	217	2880	21
OCTOBER	210	3045	21
NOVEMBER	165	2546	22
DECEMBER	220	2356	37
TOTAL	-	-	-
AVERAGE	188	2665	23

COMMENTS

The average MLSS concentration of 2665 ppm and the organic loading ratio of 23 pounds of BOD per 100 pounds of MLSS are within the accepted limits of good aeration tank operation. The BOD in pounds to the aeration section, the MLSS concentration, and the ratio of pounds of BOD per 100 pounds of MLSS averaged on a monthly basis are plotted on Figure 7.



DIGESTER OPERATION

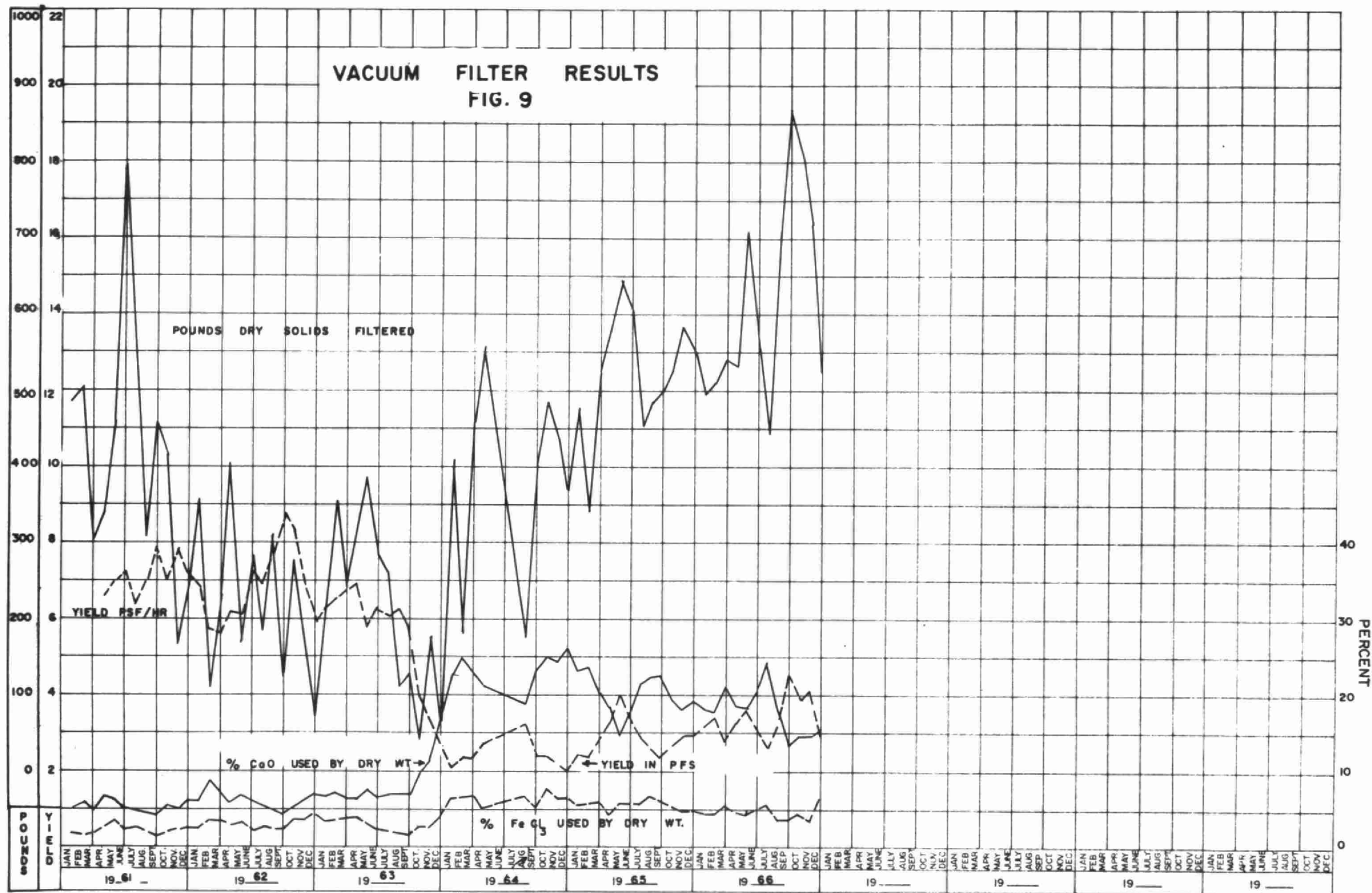
MONTH	SLUDGE TO DIGESTERS			SLUDGE FROM DIGESTERS		
	1000'S CU. FT.	% SOLIDS	% VOL. MAT	1000'S CU. FT.	% SOLIDS	% VOL. MAT
JAN.	202.56	5.59	2.97	158.22	6.63	3.42
FEB.	203.60	5.60	3.40	146.47	6.51	3.51
MAR.	225.29	5.97	3.53	158.56	5.88	3.07
APR.	283.65	4.97	2.90	176.30	5.59	2.83
MAY	228.11	7.04	4.88	185.48	6.34	3.28
JUNE	247.10	7.02	4.90	202.10	4.96	2.78
JULY	214.63	6.08	4.03	202.61	4.63	2.52
AUG.	278.28	6.80	4.52	189.79	4.38	2.17
SEPT.	311.94	6.28	4.49	98.06	-	-
OCT.	290.54	5.56	3.88	72.69	5.70	2.49
NOV.	105.94	5.00	1.51	112.52	3.50	-
DEC.	244.61	4.60	-	249.51	4.30	-
TOTAL	2836.25	-	-	1952.31	-	-
AVG.	236.35	5.88	3.73	162.69	5.31	2.90

COMMENTS

An average of 236,350 cubic feet of sludge per month was pumped to the primary digesters. The sludge contained an average of 5.88 percent total solids, of which 63.3% was volatile matter. Digested sludge from the primary digesters contained an average of 5.31% total solids, of which 54.5% was volatile matter. The average reduction in volatile matter was 30.5%. A total primary digester capacity of 900,000 gallons provided an average retention time of 18.6 days in 1966 compared with 22.5 days in 1965. The shorter retention is reflected in a smaller reduction in volatile matter which average 47.7 percent in 1965.

Raw sludge solids, expressed as percent by weight and averaged on a monthly basis are plotted on Figure 8. The volume of sludge per month pumped to the digesters is also shown.

VACUUM FILTER RESULTS FIG. 9



VACUUM FILTER OPERATION

MONTH	FILTER HOURS		% SOLIDS DIGEST SLUDGE	LBS. DRY SOLIDS FILTERED	LBS. LIME	* % LIME	LBS. FeCl ₃	% FeCl ₃	% SOLIDS FILTERED SLUDGE	YIELD PSF/HOUR
	# ₁	# ₂								
JAN.	306.0	-	6.40	493300	90320	18.3	21731	4.4	21.0	3.20
FEB.	282.9	-	7.00	511100	86810	17.0	21983	4.3	22.5	3.50
MAR.	383.0	-	5.80	541500	114470	21.1	28032	5.2	20.0	2.80
APR.	316.0	-	6.20	515900	96600	18.7	24054	4.7	20.3	3.30
MAY.	392.5	-	6.80	706700	121515	17.2	31093	4.4	19.8	3.60
JUNE	352.5	-	5.40	553500	113500	20.5	27870	5.0	19.2	3.14
JULY	342.0	-	4.69	441900	110110	24.9	25044	5.7	18.7	2.59
AUG.	423.3	-	5.13	694600	118810	17.1	26141	3.8	19.2	3.28
SEPT.	390.0	-	6.20	877300	114965	13.1	32952	3.8	19.8	4.50
OCT.	411.5	-	5.60	818800	116890	14.3	35127	4.3	20.5	3.90
NOV.	344.5	-	6.00	713100	103190	14.5	27590	3.9	17.6	4.10
DEC.	348.5	-	5.30	480800	103040	21.4	31850	6.6	15.9	2.80
TOTAL	4292.7	-	-	7348500	1290220	-	333467	-	-	-
AVG.	357.7	-	5.88	612375	107518	17.6	27789	4.5	19.5	3.39

* LIME IS EXPRESSED AS 100% CAO

COMMENTS

The average filter yield of 3.39 pounds per square foot per hour is within the range of anticipated yields for a combination of digested primary and activated sludge. Vacuum filtration increased the average solids concentration from 5.88% to 19.5%. Pounds of dry solids filtered, filter yield, and percent filter chemicals used, averaged on a monthly basis are plotted on Figure 9.

CHLORINATION

MONTH	PLANT FLOW (MG)	POUNDS CHLORINE	DOSAGE RATE (PPM)
JANUARY	287.70	10695	3.72
FEBRUARY	269.80	8990	3.33
MARCH	322.80	10575	3.28
APRIL	286.00	8390	2.93
MAY	288.90	9250	3.20
JUNE	284.70	12290	4.32
JULY	249.50	12050	4.83
AUGUST	276.30	13140	4.76
SEPTEMBER	257.10	17015	6.62
OCTOBER	268.50	22905	8.53
NOVEMBER	312.50	11910	3.81
DECEMBER	354.00	12507	3.53
TOTAL	3457.80	149717	-
AVERAGE	28.815	12476	4.33

COMMENTS

An average chlorine dosage rate of 4.33 ppm was required to maintain a residual of 0.5 ppm after 15 minutes' contact.

Prechlorination of the influent sewage to control odours in the grit building was practised from June to October, accounting for the increased dosage.

LABORATORY LIBRARY



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CONCLUSIONS

The average BOD and suspended solids removals were 94.0 percent and 94.5 percent respectively. Throughout the year the plant staff operated a clean, attractive and efficient plant for the City of Kitchener.

RECOMMENDATIONS

The average daily flow in 1966 of 9.5 million gallons is approaching the available hydraulic capacity of the aeration section. During the year, only 75% of the aeration section could be utilized due to power limitations. It is recommended that electric power be supplied by the Kitchener Public Utilities Commission to eliminate the present power limitations so that the entire aeration section can be placed in operation.

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